FINAL REPORT

Microbiological Sampling Report

for

National Oceanic & Atmospheric Administration

Sampling Conducted at Building SSMC-4

On September 21 – 23, 1999

Interagency Agreement #: D8H00CO36100

Task: 9903

December 9, 19999

Prepared by

US Public Health Service

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Executive Summary

At the request of the National Oceanic & Atmospheric Administration (NOAA), surface tape-lift, swab, and vacuum cassette dust samples were collected from mechanical rooms and occupied areas at Building SSMC-4, located at 1305 East-West Highway, Silver Spring, Maryland. Sampling strategy was developed by Joe Spurgeon, CIH, Ph.D., representing Federal Occupational Health (FOH). Sampling was performed by Dr. Spurgeon and field personnel from Aerosol Monitoring & Analysis, Inc. (AMA) during September 21 - 23, 1999. The objective of this sampling was to determine whether there is any surface fungal, especially for *Stachybotrys chartarum* (SC), contamination at the mechanical rooms and some selective occupied areas.

Sixty-eight (68) tape-lift samples and 28 swabs were collected from mechanical rooms. Twenty-four (24) swabs and 24 vacuum cassette dust samples were collected from Occupied areas. Microscopic analysis was performed on tape-lift samples. Dilution plating and direct plating was conducted on swab and cassette dust samples, respectively.

With limited analysis performed on vacuum cassette dust samples collected, *Stachybotrys chartarum* was detected from five samples at four sampling locations: 12413, 12402, 12424, and 4645. Two swab samples collected from the return plenum on top of the light at areas 12413 and 12430 showed 80 CFU/swab and 260 CFU/swab of *Stachybotrys chartarum,* respectively. With limited data collected from this facility, surface fungal burden on supply diffusers was lower than that of return troughers. Fungal burden on surfaces of return troughers of concerned areas was not higher than that of control areas.

No *Stachybotrys*-like spores were detected from any tape-lifted samples collected from mechanical rooms.

None of swab samples collected from mechanical rooms showed presence of *Stachybotrys chartarum.* Signs of fungal contamination or growth were detected from some tape-lift samples collected at each floor. Surface fungal levels on vortex blade face ranged from below the detection limits of 40 CFU/swab to 10^5 CFU/swab. Predominant fungal genus detected was common outdoor fungus, *Cladosporium*.

Recommendations for the facility are provided as follows:

Immediate measures

· Perform a thorough cleaning at 12413 and 12430 areas. Damp wipe all surfaces of supply diffusers and return troughers, and vacuum carpet and panel surfaces with High Efficiency Particulate Air (HEPA) vacuum cleaners.

· HEPA vacuum carpets and panel surfaces at locations 12424 and 4645.

· It is prudent to HEPA vacuum porous surfaces (i.e. carpet, panels, etc.) of all concerned areas such as: 3614, 4157, 4600, 4645, 11205, and 13442.

· Investigate *Stachybotrys chartarum* -positive areas to identify reservoirs of this fungus, if any.

Long-term measures

· Use HEPA vacuum cleaners for routine office cleaning.

· Investigate water intrusion problems and permanently fix them to prevent recurring of the problems.

· Properly maintain each air handler units in the mechanical rooms.

INTRODUCTION

At the request of the National Oceanic & Atmospheric Administration (NOAA), surface tape-lift, swab, and vacuum cassette dust samples were collected from mechanical rooms and selected occupied areas[1] at Building SSMC-4, located at 1305 East-West Highway, Silver Spring, Maryland. Sampling strategy was developed by Joe Spurgeon, CIH, Ph.D., representing Federal Occupational Health (FOH). Sampling was performed by Dr. Spurgeon and field personnel from Aerosol Monitoring & Analysis, Inc. (AMA) during September 21 - 23, 1999. The objective of these samplings was to determine whether there is surface fungal, especially for *Stachybotrys chartarum* (SC), contamination at the mechanical rooms and some selected occupied areas.

EVALUATION METHODOLOGY

Field Sampling

Tape-lift Sampling

Sixty-eight (68) tape-lift samples were collected from mechanical rooms of SSMC-4. Three samples were collected from each mechanical room of floors 1-13: one from the fresh air intake-above filter metal ledge, one from filter banks metal ledge, and one from vortex blade face-metal fan. Each sample was collected by pressing a piece (about 2 inches long) of double-sided tape onto the surface of interest. The tape was then transferred to a frosted microscope slide. All samples were sent to the P & K Microbiology Services, Inc. (P & K) for optical microscopy and fungal spore identification.

Vacuum Cassette Sampling

Twenty-four (24) samples were collected from surfaces of carpet or partition panels. Specific sampling locations were selected by NOAA and are presented in Table 1. Samples were collected using open-face, 25-mm cassettes with 0.8 mm MCE filters attached with a high flow rate pump. According to AMA, samples were collected by placing the cassette open to the object (panel or carpet) and holding steadily for 1 minute (flow rate of 14L/min). All samples were sent to the P & K for analysis.

Table 1. Summaries of sampling locations for vacuum cassette samples collected from SSMC-4, on September 23, 1999.

Building	**Condition**	Room / Cubicle #s	**Total Sample Number**
SSMC-4	Control*	3216, 3552, 4535, 11437, 12156, 13134	9
SSMC-4	Concerned*	3614, 4645, Fax station (4th floor) , Microfilm cubicle (4th floor), 11205, 12413, 12424, 12430, 13442	15

* Concerned: Areas had water damage or mold growth according to NOAA.

Control: Areas where no water damage occurred as identified by NOAA.

Swab Sampling

One swab sample was collected from metal surfaces of vortex blade face at each Mechanical rooms of each floor (floors 1-13). A total of 28 swabs were collected.

Twenty-four (24) swab samples were collected from occupied areas of 3rd, 4th, 11th, and 12th floors (Table 2). These locations were similar to those selected for vacuum cassette dust samples. Sterilized swabs were used to wipe on surfaces of supply diffusers and return troughers at the light fixture. According to AMA, the sampling area was approximately 4 in^2. All samples were sent to P & K for fungal analyses.

Table 2. Summaries of swab sampling locations at SSMC-4, on September 21 - 23, 1999.

Building	Floor	Room #s	Total Sample Number
SSMC-4	1-13	Mechanical room	28
SSMC-4	12	12156, 12413, 12424, 12430	6
SSMC-4	11	11205, 11437	4
SSMC-4	4	4157, 4535, 4600, 4645	8
SSMC-4	3	3216, 3552, 3615	6

Laboratory Procedures

Tape-lift Samples

According to P & K through a phone conversation, samples were first examined under a stereoscope. A section of ¾ - 1 inch of the tape from each sample was cut and examined under a compound microscope. The laboratory reported fungal spores as *Cladosporium*-like, *Alternaria*-like, *Stachybotrys*-like, etc. Qualitative information (ranged from massive to trace to no growth) was provided for each sample collected (see Attachment).

Vacuum Cassette Dust Samples

According to P & K through a phone conversation, insufficient dust was collected for analysis. Therefore, the filter with trace dust collected was placed onto an agar plate filled with corn meal agar (CMA). Total fungal colonies formed on each CMA plate were counted, recorded, and identified.

Swab Samples

Each swab sample was processed through dilution plating on malt extract agar (MEA) and CMA. Total fungal colonies formed on each plate were counted, recorded, and identified.

RESULTS AND DISCUSSION

All analytical reports are presented in Attachment.

Tape-lift Samples

No *Stachybotrys*-like spores were detected from any samples collected. None of the samples collected showed massive fungal growth. Signs of fungal contamination or growth (evaluated by the presence of hyphae, conidiophores, and spores) were detected from some samples on each floor (Table 3). *Cladosporium*-like spores were the predominant fungi detected from these samples.

Table 3. Sampling locations suggested fungal contamination from tape-lifted samples collected at different areas of mechanical rooms of SSMC-4, on September 21, 1999.

Building	**Floor**	AHU	Sampling Location	**Predominant Fungal Genera**
SSMC-4	13	**13NW**	Vortex blade face-fan metal	*Cladosporium*-like
SSMC-4	13	13SE	Vortex blade face- metal fan	*Cladosporium*-like
SSMC-4	12	12NW	Vortex blade face-fan metal	*Cladosporium*-like
SSMC-4	12	12SE	Vortex blade face- metal fan	*Cladosporium*-like
SSMC-4	12	SF12	Fresh air intake-above filter-metal	*Cladosporium*-like
SSMC-4	11	11NW	Vortex blade face-fan metal	*Cladosporium*-like
SSMC-4	11	11SE	Vortex blade face-fan metal	*Cladosporium*-like
SSMC-4	11	SF11	Above filter-fresh air inlet	*Cladosporium*-like
SSMC-4	10	10SE	Vortex blade face-fan metal	*Cladosporium*-like
SSMC-4	10	SF10	Fresh air inlet-ledge above filter	*Cladosporium*-like
SSMC-4	9	09SE	**Vortex blade face-fan metal**	*Cladosporium*-like
SSMC-4	8	08NW	Vortex blade fan metal	*Cladosporium*-like
SSMC-4	8	08SE	Vortex blade fan face-metal	*Cladosporium*-like
SSMC-4	8	SF08	Fresh air inlet-above filter	*Cladosporium*-like
SSMC-4	7	07NW	Vortex blade fan-face metal	*Cladosporium*-like
SSMC-4	7	SF07	Fresh air inlet- above filter ledge	*Cladosporium*-like
SSMC-4	6	06NW	Vortex blade face-fan metal	*Cladosporium*-like
SSMC-4	6	06SE	Vortex blade face-fan metal	*Cladosporium*-like
SSMC-4	6	SF6	Fresh air inlet-above filter	*Cladosporium*-like
SSMC-4	5	5NW	Vortex blade face-fan metal	*Cladosporium*-like
SSMC-4	5	5SE	Vortex blade face-fan metal	*Cladosporium*-like
SSMC-4	5	SF5	Fresh air inlet-above filter	*Cladosporium*-like
SSMC-4	4	4SE	Vortex blade face-fan metal	*Cladosporium*-like
SSMC-4	4	SF4	Fresh air inlet-ledge above filter	*Cladosporium*-like
SSMC-4	3	3NW	Vortex blade face-fan metal	*Cladosporium*-like
SSMC-4	3	3SE	Vortex blade face-fan metal	*Cladosporium*-like
SSMC-4	2	2NW	Vortex blade face-fan metal	*Cladosporium*-like

SSMC-4	2	SF2	Fresh air inlet-above filter	*Cladosporium*-like
SSMC-4	1	1WG	Filter bank-ledge metal	*Cladosporium*-like

The interpretation of these results is difficult. This is due to (1) only a small sample area (2-inch in length) from surfaces of interest was collected, (2) only portions of the collected tape were examined under microscope, and (3) there were no replications.

Vacuum Cassette Dust Samples

Stachybotrys chartarum was detected from five of 24 samples at four locations: 12413, 12424, 12430, and 4645. Levels of *Stachybotrys chartarum* detected ranged from 1 CFU to 5 CFU (Table 4).

The interpretation of these vacuum cassette sample results is difficult. The reasons are three-fold: (1) only a small sample area (4.91 cm^2) from surfaces of interest was collected, (2) insufficient amounts of dust were collected for analysis, and (3) no replications. Nevertheless, SC-positive results indicated presence of *Stachybotrys chartarum* on surfaces sampled.

Table 4. Summaries of locations showed presence of *Stachybotrys chartarum* (SC) on corn meal agar by vacuum cassette sampling on September 23, 1999.

Building	Floor	Room	Surfaces	SC level
SSMC-4	12	12430	Carpet	1 CFU

SSMC-4	12	12430	Panel	4 CFU
SSMC-4	12	12424	Panel	2 CFU
SSMC-4	12	12413	Panel	5 CFU
SSMC-4	4	4645	Carpet	1 CFU

Swab Samples

Mechanical Rooms

None of the 28 samples collected from mechanical rooms showed the presence of *Stachybotrys chartarum* either on MEA or CMA plates. Most of fungal levels ranged from below the detection limits of 40 CFU/swab to 10^3 CFU/swab level, except for eight samples where fungal levels were at $10^4 – 10^5$ CFU/swab levels (Table 5). *Cladosporium* was the predominant fungal genus recovered from these samples.

Occupied Areas

Two samples collected from surfaces of return light plenums on the 12^{th} floor (areas 12413 and 12430) showed the presence of *Stachybotrys chartarum*. Mean *Stachybotrys chartarum* level was 80 CFU/swab and 260 CFU/swab, respectively. Aforementioned, *Stachybotrys chartarum* was also detected from vacuum cassette samples collected from these two areas.

In general, surface fungal burden on surfaces of supply diffusers was lower than that of return troughers at each location. With limited data collected, total fungal burden on surfaces of return troughers at control areas was not lower than that of concerned areas (Table 6).

Table 5. Mean surface fungal burden (CFU/swab) on samples collected from surfaces of Mechanical rooms at SSMC-4, on September 21, 1999.

Building	Floor	Room	AHU	Surface	Fungal Levels
SSMC-4	13	ME1	13NW	Vortex blade face – fan metal	19,520
SSMC-4	12	ME1	12NW	Vortex blade face – fan metal	430,500
SSMC-4	12	ME1	12SE	Vortex blade face – fan metal	12,000
SSMC-4	10	ME1	10NW	Vortex blade face – fan metal	289,050
SSMC-4	10	ME1	10SE	Vortex blade face – fan metal	13,680
SSMC-4	9	ME1	9SE	Vortex blade face – fan metal	379,250
SSMC-4	8	ME1	8NW	Vortex blade face – fan metal	597,800
SSMC-4	7	ME1	7NW	Vortex blade face – fan metal	161,950

Table 6. Mean surface fungal burden (CFU/swab) on supply diffusers and return troughers collected from various floors at SSMC-4 on September 23, 1999.

Building	Condition	Rooms/ Cubicles	Supply Diffusers	Return Troughers
SSMC-4	Control*	12156	<40	200
SSMC-4	Control	11437	210	680
SSMC-4	Control	4535	<40	1,400
SSMC-4	Control	3552	<40	40
SSMC-4	Control	3216	<40	160
SSMC-4	Concerned*	12430	60	740
SSMC-4	Concerned	12424 - 12413	140	320
SSMC-4	Concerned	11205	300	180
SSMC-4	Concerned	4157	220	640
SSMC-4	Concerned	4600	40	960
SSMC-4	Concerned	4645	60	1,100
SSMC-4	Concerned	3615	<40	560

* Concerned: Areas had water damage or mold growth according to NOAA.

Control: Areas where no water damage occurred as identified by NOAA.

CONCLUSIONS

Mechanical Rooms

No *Stachybotrys*-like spores were detected from any tape-lifted samples collected. None of the swab samples collected from mechanical rooms showed presence of *Stachybotrys chartarum.* Signs of fungal contamination or growth (evaluated by the presence of hyphae, conidiophores, and spores) were detected from some tape-lift samples collected from mechanical rooms of each floor. Fungal levels on surfaces of vortex blade face ranged from below the detection limits of 40 CFU/swab to 10^5 CFU/swab. Predominant fungal genus detected was common outdoor fungus, *Cladosporium*.

Occupied Areas

Using vacuum cassette dust samples, *Stachybotrys chartarum* was detected from carpet and panel surfaces of area 12430, panel surfaces at areas 12424 and 12413, and carpet surfaces of area 4645.

Two samples collected from the return plenum on top of the light at areas 12430 and 12424 showed 80 CFU/swab and 260 CFU/swab of *Stachybotrys chartarum*, respectively. With limited data collected from various floors, surface fungal burden on supply diffusers was lower than that of return troughers. Fungal burden on surfaces of return troughers of concerned areas was not higher than that of control areas.

RECOMMENDATIONS

Immediate measures

· Perform a thorough cleaning at 12413 and 12430 areas. Damp wipe all surfaces of supply diffusers and return troughers, and vacuum carpet and panel surfaces with High Efficiency Particulate Air (HEPA) vacuum cleaners.

· HEPA vacuum carpets and panel surfaces at locations 12424 and 4645.

· It is prudent to HEPA vacuum porous surfaces (i.e. carpet, panels, etc.) of all concerned areas such as: 3614, 4157, 4600, 4645, 11205, and 13442.

· Investigate *Stachybotrys chartarum*-positive areas to identify reservoirs of this fungus, if any.

Long-term measures

· Use HEPA vacuum cleaners for routine office cleaning.

· Investigate water intrusion problems and permanently fix them to prevent recurring of the problems.

· Properly maintain each air handler units in the mechanical rooms.

ATTACHMENT

Microbiological laboratory reports for samples collected

from building SSMC-4, on September 21 – 23, 1999

All attachments can be retrieved from the Library located on the Second Floor in SSMC 3

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[1] Selected areas which have experienced chronic water intrusion were identified by NOAA, and investigated by FOH.